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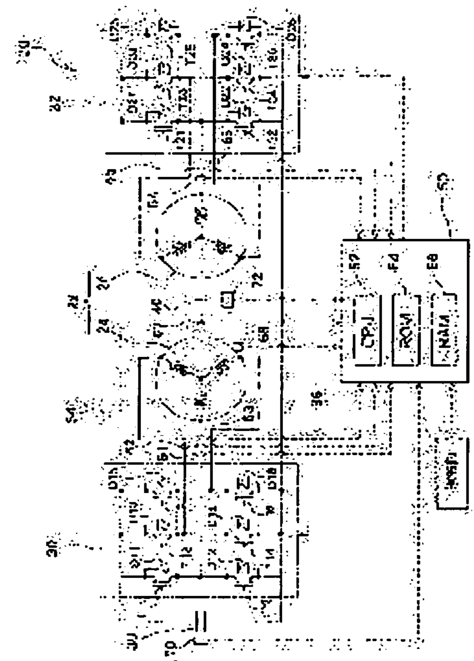
(54) POWER OUTPUT EQUIPMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To enhance the upper limit of the output torque from a motor without affecting the voltage of a capacitor as a drive power source.
SOLUTION: A DC power source 40 is connected between the neutral points of the three-phase coils 24 and 26 of two Y connections without discrepancy of winding angle which are supplied severally with three-phase AC power from two inverter circuits 30 and 32 sharing a positive electrode bus 34 and a negative electrode bus 36, and also a capacitor 38 is connected between the positive electrode bus 34 and the negative electrode bus 36. The supply of the three-phase AC power is performed by the PWM control by the comparison between modulated waves, where tertiary harmonics having the same amplitude and frequency mutually in the same phase are superposed each on the three-phase modulated waves having the same amplitude and frequency mutually in the same phase, and triangular waves. Consequently, it is possible to enhance the upper limit of the output torque from a motor by reducing the amplitude maximum value of the modulated waves without oscillating the potential difference between the neutral points, that is, the voltage of the capacitor.



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CLAIMS

[Claim(s)]
[Claim 1]
Two star connection coils which have the same phase mutually,
Two inverter circuits which can supply polyphase current power to said two star connection coils which share a positive-electrode bus-bar and a negative-electrode bus-bar, are constituted, and correspond by switching of a switching element,
The 1st power source connected to said positive-electrode bus-bar and said negative-electrode bus-bar,
The 2nd power source connected during said two neutral points of a star connection coil,
two star connection coils which correspond by switching of the switching element of said two inverter circuits using a subcarrier and a modulated wave -- the current of an inphase -- impressing -- each -- in case the same power is outputted, after securing the output of this power, the amplitude maximum of each modulated wave corresponding to said two inverter circuits is decreased uniformly -- making -- this -- the control means which carries out switching control of the switching element of two inverter circuits
Preparation ****** output unit.
[Claim 2]
It is a power output unit according to claim 1,
Said 1st power source is a power output unit which is the accumulation-of-electricity means in which charge and discharge are possible.
[Claim 3]
It is a power output unit according to claim 1 or 2,
Said control means is a power output unit which is a means to decrease said amplitude maximum uniformly by making the 3rd higher harmonic superimpose of said modulated wave in each.
[Claim 4]
It is a power output unit according to claim 1 or 2,
Said control means is a power output unit which is a means for the forward side of said 2nd power source to have subtracted and obtained the electrical potential difference of said 1st power source from the maximum in each phase modulated wave to the star connection coil connected at the neutral point and to decrease said amplitude maximum uniformly as the amendment wave centering on the forward side electrical potential difference of said 2nd power source is superimposed of said modulated wave in each and it is in agreement with the electrical potential difference of said 1st power source in the maximum electrical potential difference of a modulated wave.
[Claim 5]
It is a power output unit according to claim 1 or 2,
Said control means is a power output unit which is a means for the negative side of said 2nd power source to have subtracted and obtained the electrical potential difference of said 1st power source from the minimum value in each phase modulated wave to the star connection coil connected at the neutral point and to decrease said amplitude maximum uniformly as the amendment wave centering on the negative side electrical potential difference of said 2nd power source is superimposed of said modulated wave in each and it is in agreement with the negative side electrical potential difference of said 1st power source in the minimum electrical potential difference of a modulated wave.
[Claim 6]
There is no claim 1 and it is the power output unit of one publication 5 either,
Said two star connection coils are power output units which are formed corresponding to one Rota and constitute one motor.

[Claim 7]
Two star connection coils which have the same phase mutually, and positive-electrode bus-bars and negative-electrode bus-bars are shared. Two inverter circuits which can supply polyphase current power to each of said two star connection coils, The 1st power source connected to said positive-electrode bus-bar and said negative-electrode bus-bar, and the 2nd power source connected during said two neutral points of a star connection coil, It is a power output unit equipped with the control means which carries out switching control of the switching element of said two inverter circuits so that the current of an inphase may be impressed to two corresponding star connection coils and the same power may be outputted respectively,
it uses in common and attaches in two coils of an inphase among each phase of one star connection coil, and each phase of the star connection coil of another side -- having -- this -- an addition current detection means to detect the addition current of each current which flows two coils,
A phase current calculation means to compute the phase current which flows each phase of said two star connection coils from the addition current which was used for control of said control means and detected by said addition current detection means
Preparation ****** output unit.
[Claim 8]
It is a power output unit according to claim 7,
A current detection means during the neutral point to detect the current which flows between said neutral points,
Said phase current calculation means is a power output unit which is a means to compute said each phase current based on the addition current detected by said addition current detection means, and the current during the neutral point detected by said current detection means during the neutral point.
[Claim 9]
It is a power output unit according to claim 8,
Said phase current calculation means is a power output unit which is a means to compute said each phase current based on the value which doubled the addition current detected by said addition current detection means 1/2, and the value which **(ed) the current during the neutral point detected by said current detection means during the neutral point with the source resultant pulse number of said star connection coil.
[Claim 10]
There is no claim 7 and it is the power output unit of one publication 9 either,
Said two star connection coils are power output units which are formed corresponding to one Rota and constitute one motor.

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to a power output unit.
[0002]
[Description of the Prior Art]
Conventionally, the power output unit equipped with the DC power supply connected at the capacitor, the positive-electrode bus-bar of an inverter circuit or negative-electrode bus-bar connected to the positive-electrode bus-bar and negative-electrode bus-bar of the inverter circuit which impresses the three-phase alternating current to a motor, and the neutral point of a motor is proposed (for example, JP,10-337047,A (patent reference 1), JP,11-178114,A (patent reference 2), etc.). With this equipment, it considers that the capacitors which it stored electricity while carrying out the pressure up of the electrical potential difference of DC power supply and storing in the capacitor the circuit which consists of a coil of each phase of a motor and a switching element of an inverter circuit are DC power supply, and a motor is driven. Accommodation of the accumulation-of-electricity electrical potential difference of a capacitor is performed by controlling the potential of the neutral point of control, i.e., a motor, in the dc component of the three-phase alternating current impressed to a motor.
[0003]
By the way, what impresses the three-phase alternating current based on the comparison with the thing which made the 3rd higher harmonic superimpose on the three phase electrical-potential-difference command (modulated wave) in PWM (Pulse Density Modulation) control as a power output unit which raises the use effectiveness of the electrical potential difference of DC power supply, and raises the output of a motor, and the triangular wave which is a subcarrier to a motor is proposed (for example, JP,10-210756,A (patent reference 3) etc.). If the 3rd higher harmonic is made to superimpose on a modulated wave, since the amplitude of a modulated wave can be decreased without reducing the output of a motor, the large amplitude of the decrement modulated wave can be taken, and the maximum output of a motor can be raised as the result.
[0004]
[Patent reference 1]
JP,10-337047,A
[Patent reference 2]
JP,11-178114,A
[Patent reference 3]
JP,10-210756,A
[0005]
[Problem(s) to be Solved by the Invention]
However, if the 3rd higher harmonic is made to superimpose when driving a motor using the accumulation-of-electricity electrical potential difference of a capacitor, since the dc component (potential of the neutral point of a motor) of the three-phase alternating current generated by the PWM modulation may vibrate, it will not be able to hold the accumulation-of-electricity electrical potential difference of a capacitor on a target electrical potential difference, but will be vibrated. Consequently, a torque ripple will arise in the motor driven using the accumulation-of-electricity electrical potential difference of a capacitor.
[0006]
Moreover, the switching control of the switching element of an inverter circuit can perform the drive of a

motor using the detection result by the current sensor attached in each phase of a three phase coil. However, when a current sensor must be attached in at least two of each phases of a three phase coil at this time and it has two or more such three phase coils, many current sensors will be needed and equipment will form high cost. For this reason, it is desirable to reduce the current sensors prepared in a power output unit as much as possible, and to attain low cost-ization.

[0007]

The power output unit of this invention sets enabling it to output higher power, using the 1st power source more efficiently, after solving such a technical problem and securing the output of the power demanded to one of the purposes. Moreover, the power output unit of this invention sets enabling it to output higher power, using the 1st power source more efficiently to one of the purposes, without affecting the electrical potential difference of the 1st power source as an accumulation-of-electricity means in which charge and discharge are possible.

[0008]

Moreover, the power output unit of this invention sets to one of the purposes to reduce the number of the current detection means used for the switching control of an inverter circuit, and to realize low cost-ization of equipment.

[0009]

[The means for solving a technical problem, and its operation and effectiveness]

The power output unit of this invention took the following means, in order to attain a part of above-mentioned purpose [at least].

[0010]

The 1st power output unit of this invention,

Two star connection coils which have the same phase mutually,

a positive-electrode bus-bar and a negative-electrode bus-bar are shared, and it is constituted, and corresponds by switching of a switching element -- this -- two inverter circuits which can supply polyphase current power to two star connection coils,

The 1st power source connected to said positive-electrode bus-bar and said negative-electrode bus-bar,

The 2nd power source connected during said two neutral points of a star connection coil,

two star connection coils which correspond by switching of the switching element of said two inverter circuits using a subcarrier and a modulated wave -- the current of an inphase -- impressing -- each -- in case the same power is outputted, the amplitude maximum of each modulated wave corresponding to said two inverter circuits is decreased uniformly, securing the output of this power -- making -- this -- the control means which carries out switching control of the switching element of two inverter circuits

Let preparation ****** be a summary.

[0011]

In the 1st power output unit of this this invention, in case the current of an inphase is impressed to two star connection coils which correspond by switching of the switching element of two inverter circuits using a subcarrier and a modulated wave and the same power is outputted respectively, a control means decreases uniformly the amplitude maximum of each modulated wave corresponding to two inverter circuits, after securing the output of that power, and carries out switching control of the switching element of an inverter circuit. Therefore, the upper limit of the power outputted by reduction of the amplitude maximum of a modulated wave from equipment, using the electrical potential difference of the 1st power source efficiently can be raised more, without affecting the potential difference during the two neutral points of a star connection coil at the electrical potential difference of effect, i.e., the 1st power source.

[0012]

In the 1st power output unit of such this invention, said 1st power source shall be an accumulation-of-electricity means in which charge and discharge are possible.

[0013]

Moreover, in the 1st power output unit of this invention, said control means shall be a means to decrease said amplitude maximum uniformly, by making the 3rd higher harmonic superimpose of said modulated wave in each.

[0014]

In the 1st power output unit of this invention moreover, said control means From the maximum in each phase modulated wave to the star connection coil to which the forward side of said 2nd power source is connected at the neutral point As the amendment wave centering on the forward side electrical potential difference of said 2nd power source which subtracted and obtained the electrical potential difference of said

1st power source is superimposed of said modulated wave in each and it is in agreement with the electrical potential difference of said 1st power source in the maximum electrical potential difference of a modulated wave, said amplitude maximum can also be made into the uniform means to decrease.

[0015]

By this, the maximum electrical potential difference of a modulated wave can be made in agreement with the electrical potential difference of said 1st power source, and the electrical-potential-difference utilization factor of the 2nd power source can be made into max.

[0016]

In the 1st power output unit of this invention moreover, said control means From the minimum value in each phase modulated wave to the star connection coil to which the negative side of said 2nd power source is connected at the neutral point As the amendment wave centering on the negative side electrical potential difference of said 2nd power source which subtracted and obtained the electrical potential difference of said 1st power source is superimposed of said modulated wave in each and it is in agreement with the negative side electrical potential difference of said 1st power source in the minimum electrical potential difference of a modulated wave, said amplitude maximum can also be made into the uniform means to decrease.

[0017]

By this, the minimum electrical potential difference of a modulated wave can be made in agreement with the negative side electrical potential difference of said 1st power source, and the electrical-potential-difference utilization factor of the 2nd power source can be made into max.

[0018]

Furthermore, in the 1st power output unit of this invention, said two star connection coils shall be prepared corresponding to one Rota, and shall constitute one motor.

[0019]

The 2nd power output unit of this invention,

Two star connection coils which have the same phase mutually, and positive-electrode bus-bars and negative-electrode bus-bars are shared. Two inverter circuits which can supply polyphase current power to each of said two star connection coils, The 1st power source connected to said positive-electrode bus-bar and said negative-electrode bus-bar, and the 2nd power source connected during said two neutral points of a star connection coil, It is a power output unit equipped with the control means which carries out switching control of the switching element of said two inverter circuits so that the current of an inphase may be impressed to two corresponding star connection coils and the same power may be outputted respectively, it uses in common and attaches in two coils of the inphase of each phase of one star connection coil, and each phase of the star connection coil of another side -- having -- this -- an addition current detection means to detect the addition current of each current which flows two coils,

A phase current calculation means to compute the phase current which flows each phase of said two star connection coils from the addition current which was used for control of said control means and detected by said addition current detection means

Let preparation ****** be a summary.

[0020]

In the 2nd power output unit of this this invention, in response to supply of the current of an inphase, respectively, an output is possible for while and the addition current detection means shared and attached in two coils of the inphase of each phase of a star connection coil and each phase of the star connection coil of another side the same power The addition current of each current which flows two coils is detected, and the phase current to which a phase current calculation means flows each phase of two star connection coils from the addition current detected by the addition current detection means is computed. Therefore, since it is not necessary to prepare a current sensor for every phase of two star connection coils in order to detect the phase current used for the switching control of the switching element of an inverter circuit, the number of current sensors is reducible. Consequently, low cost-ization of equipment is realizable.

[0021]

In the 2nd power output unit of such this invention, it shall have a current detection means during the neutral point to detect the current which flows between said neutral points, and said phase current calculation means shall be a means to compute said each phase current based on the addition current detected by said addition current detection means, and the current during the neutral point detected by said current detection means during the neutral point. In the 2nd power output unit of this invention of this mode, said phase current calculation means shall be a means to compute said each phase current based on the value which doubled the addition current detected by said addition current detection means 1/2, and the value which **(ed) the

current during the neutral point detected by said current detection means during the neutral point with the source resultant pulse number of said star connection coil.

[0022]

Moreover, in the 2nd power output unit of this invention, said two star connection coils shall be prepared corresponding to one Rota, and shall constitute one motor.

[0023]

[Embodiment of the Invention]

Next, the operation gestalt of this invention is explained. Drawing 1 is the block diagram showing the outline of the configuration of the power output unit 20 which is 1 operation gestalt of this invention. The double winding motor 22 which has two three phase coils 24 and 26 by which Y connection was carried out so that the power output unit 20 of an operation gestalt may be illustrated (henceforth 2Y motor), Two inverter circuits 30 and 32 which are respectively connected to two three phase coils 24 and 26, and share the positive-electrode bus-bar 34 and the negative-electrode bus-bar 36, It has the capacitor 38 connected to the positive-electrode bus-bar 34 and the negative-electrode bus-bar 36, DC power supply 40 prepared during the neutral point of two three phase coils 24 and 26 of the 2Y motor 22, and the electronic control unit 50 which controls the whole equipment.

[0024]

Drawing 2 is an explanatory view which illustrates the relation of two three phase coils 24 and 26 of the 2Y motor 22. The 2Y motor 22 consists of Rota where the permanent magnet was stuck on the outside surface, and a stator wound so that it might illustrate to drawing 2 and the coil include angle of two three phase coils 24 and 26 of the same coil specification might turn into 0 times, and is carrying out the same configuration as the synchronous generator motor in which the usual generation of electrical energy is possible except for the point that two three phase coils 24 and 26 are wound. What is necessary is just to control inverter circuits 30 and 32 so that the three-phase alternating current of an inphase is respectively impressed to the three phase coils 24 and 26 by inverter circuits 30 and 32 in order to drive such a 2Y motor 22. In addition, the revolving shaft of the 2Y motor 22 is the output shaft of the power output unit 20 of an operation gestalt, and power is outputted from this revolving shaft. Since it is constituted as a generator motor as mentioned above, the 2Y motor 22 of an operation gestalt can be generated by the 2Y motor 22, if power is inputted into the revolving shaft of the 2Y motor 22.

[0025]

Both the inverter circuits 30 and 32 are constituted by six diodes D11-D16, and D21-D26. [six transistors T11-T16, T21-T26, and] Six transistors T11-T16, and two T21-T26 are arranged at a time in a pair so that it may become a source and sink side to the positive-electrode bus-bar 34 and the negative-electrode bus-bar 36, respectively, and the three phase coils 24 and 26 (U1V1W1) of the 2Y motor 22 and each of (U2V2W2) are connected at the node. Therefore, if the rate of transistors T11-T16 and the ON time amount of T21-T26 of making a pair is controlled by the condition that the electrical potential difference is acting on the positive-electrode bus-bar 34 and the negative-electrode bus-bar 36, with an inphase, rotating magnetic field can be formed with the three phase coils 24 and 26 of the 2Y motor 22, and the rotation drive of the 2Y motor 22 can be carried out.

[0026]

The electronic control unit 50 is constituted as a microprocessor centering on CPU52, and is equipped with ROM54 which memorized the processing program, RAM56 which memorizes data temporarily, and input/output port (not shown). In this electronic control unit 50 U1V1W1 of the three phase coils 24 and 26 of the 2Y motor 22, The current Io during the neutral point from the current sensor 67 attached during the neutral point of the each phase currents Iu1, Iv1, Iw1, Iu2, Iv2, and Iw2 from current sensors 61-66 and the 2Y motor 22 which were attached in each phase of U2V2W2, The electrical potential difference Vc between terminals of the capacitor 38 from a voltage sensor 70 attached in the angle of rotation theta and capacitor 38 of a rotator of the 2Y motor 22 from the angle-of-rotation sensor 68 attached in the revolving shaft of the 2Y motor 22, The electrical potential difference Vb between terminals of DC power supply 40 from the voltage sensor 72 attached in DC power supply 40, the command value about the drive of the 2Y motor 22, etc. are inputted through input port. Here, it is good also as a thing of current sensors 61-63 and the current sensors 64-66 which may omit any one respectively and uses any one as a sensor only for malfunction detection. From the electronic control unit 50, the control signal for performing the transistors T11-T16 of inverter circuits 30 and 32 and switching control of T21-T26 etc. is outputted through the output port.

[0027]

Next, the principle of operation of the power output unit 20 of the operation gestalt constituted in this way is

explained. Drawing 3 is an explanatory view explained to the leakage inductance of u phase of the three phase coils 24 and 26 of the 2Y motor 22 paying attention to the neutral point of the three phase coil 24, the neutral point of the three phase coil 26, and the flow of the current in the condition that the potential difference V012 is smaller than the electrical potential difference Vb of DC power supply 40. Now, the condition of ON of the transistor T12 of an inverter circuit 30 or the condition of ON of the transistor T21 of an inverter circuit 32 is considered in the condition that the potential difference V012 of the neutral point of the three phase coil 24 and the neutral point of the three phase coil 26 is smaller than the electrical potential difference Vb of DC power supply 40. In this case, the short circuit shown by the continuous-line arrow head is formed into drawing 3 (a) and drawing 3 (b), and u phase of the three phase coils 24 and 26 of the 2Y motor 22 functions as a reactor. If the transistor T21 of an inverter circuit 32 is turned off while turning off the transistor T12 of an inverter circuit 30 from this condition, the energy stored in u phase of the three phase coil which is functioning as a reactor will be stored in a capacitor 38 by the charge circuit shown by the drawing 3 (c) solid line arrow head. Therefore, it can be considered that this circuit is the capacitor charge circuit which stores the energy of DC power supply 40 in a capacitor 38. Since this capacitor charge circuit has the same composition as a pressure-up chopper circuit, it can operate highly the electrical potential difference Vc between terminals of a capacitor 38 freely from the electrical potential difference Vb of DC power supply 40. Since it can consider that vw phase of the three phase coils 24 and 26 of the 2Y motor 22 as well as u phase is a capacitor charge circuit If the potential difference V012 of the neutral point of the three phase coil 24 and the neutral point of the three phase coil 26 considers as a condition smaller than the electrical potential difference Vb of DC power supply 40 A capacitor 38 can be charged by DC power supply 40 by both turning on and off the transistors T12, T14, and T16 of an inverter circuit 30, and the transistors T21, T23, and T25 of an inverter circuit 32.

[0028]

Drawing 4 is an explanatory view explained to the leakage inductance of u phase of the three phase coils 24 and 26 of the 2Y motor 22 paying attention to the flow of the current in the condition that the potential difference V012 of the neutral point of the three phase coil 24 and the neutral point of the three phase coil 26 is larger than the electrical potential difference Vb of DC power supply 40. Shortly, a transistor T12 has [the transistor T12 of an inverter circuit 30] the off transistor T21 of OFF and an inverter circuit 32 at ON in the condition that the potential difference V012 of the neutral point of the three phase coil 24 and the neutral point of the three phase coil 26 is larger than the electrical potential difference Vb of DC power supply 40, and a transistor T22 considers the condition of ON. In this case, the charge circuit shown by the continuous-line arrow head is formed into drawing 4 (a), and DC power supply 40 are charged using the electrical potential difference Vc between terminals of a capacitor 38. At this time, u phase of the three phase coils 24 and 26 of the 2Y motor 22 functions as a reactor like the above-mentioned. If the transistor T11 of an inverter circuit 30 is turned off from this condition or the transistor T22 of an inverter circuit 32 is turned off, the energy stored in u phase of the three phase coil which is functioning as a reactor will charge DC power supply 40 by the charge circuit shown by the drawing 4 (b) or drawing 4 (c) solid line arrow head. Therefore, it can be considered that this circuit is the DC-power-supply charge circuit which stores the energy of a capacitor 38 in DC power supply 40. Since it can consider that vw phase of the three phase coils 24 and 26 of the 2Y motor 22 as well as u phase is a DC-power-supply charge circuit, while the potential difference V012 of the neutral point of the three phase coil 24 and the neutral point of the three phase coil 26 considers as a larger condition than the electrical potential difference Vb of DC power supply 40, DC power supply 40 can be charged by the capacitor 38 by turning on and off the transistors T11-T16 of an inverter circuit 30, and the transistors T21-T26 of an inverter circuit 32.

[0029]

Thus, since a capacitor 38 can be charged by DC power supply 40 or DC power supply 40 can be conversely charged by the capacitor 38, the electrical potential difference Vc between terminals of a capacitor 38 is controllable by the power output unit 20 of an operation gestalt to a desired value. If the potential difference is produced between the terminals of a capacitor 38, since it will be in the condition that the DC power supply by the capacitor 38 were connected to the positive-electrode bus-bar 34 and the negative-electrode bus-bar 36 of inverter circuits 30 and 32 and the electrical potential difference Vc between terminals of a capacitor 38 will act as inverter input voltage Vi, drive control of the 2Y motor 22 can be carried out by carrying out switching control of the transistors T11-T16 of inverter circuits 30 and 32, and T21-T26. At this time While being able to set up freely the potentials Vu1, Vv1, and Vw1 of each phase of the three-phase alternating current impressed to the three phase coil 24 within the limits of the inverter input voltage Vi by the switching control of the transistors T11-T16 of an inverter circuit 30 Since the potentials Vu2,

Vv2, and Vw2 of each phase of the three-phase alternating current impressed to the three phase coil 26 can also be freely set up within the limits of the inverter input voltage Vi by the switching control of the transistors T21-T26 of an inverter circuit 32 The potential V01 of the neutral point of the three phase coil 24 of the 2Y motor 22 and the potential V02 of the neutral point of the three phase coil 26 can be operated freely. A wave-like (drawing 5 (b)) example of the wave (drawing 5 (a)) of the potentials Vu1, Vv1, and Vw1 of each phase of the three phase coil 24 when operating it so that the difference of the potential V01 of the neutral point of the three phase coil 24 and the potential V02 of the neutral point of the three phase coil 26 may serve as the electrical potential difference Vb of DC power supply 40 at drawing 5 , and the potentials Vu2, Vv2, and Vw2 of each phase of the three phase coil 26 is shown. The inside Vx of drawing is the median (Vi/2) of the inverter input voltage Vi. Therefore, it is operated so that the potential difference V012 during the neutral point of the three phase coils 24 and 26 of the 2Y motor 22 may become lower than the electrical potential difference Vb of DC power supply 40, and it can be operated so that the potential difference V012 during the neutral point of the three phase coils 24 and 26 may become higher than the electrical potential difference Vb of DC power supply 40 conversely, and a capacitor 38 can be charged or DC power supply 40 can be charged. The charging current of a capacitor 38 and the charging current of DC power supply 40 are controllable by going up and down the potential difference V012 during the neutral point of the three phase coils 24 and 26.

[0030]

Next, drive control of the power output unit 20 of an operation gestalt is explained. Drawing 6 is the control-block Fig. showing the drive control performed with the electronic control unit 50 of the power output unit 20 of an operation gestalt as control block. So that it may illustrate Each phase currents Iu1, Iv1, Iw1, Iu2, Iv2, and Iw2 (motor current) detected by current sensors 61-63, and 64-66 by the angle-of-rotation sensor 68 The three phase two phase transducer M1 which carries out three phase two phase (dq shaft) conversion using the angle of rotation theta of Rota of the detected 2Y motor 22 (rotation location), The subtractor M2 which calculates the deflection delta Id and delta Iq with the currents Id and Iq in which three phase two phase conversion was carried out by current command value Id* inputted as one of the command values about the drive of the 2Y motor 22, Iq* (dq shaft current command), and the three phase two phase transducer M1, The PI control section M3 which calculates the electrical-potential-difference control inputs Vd and Vq for motorised current adjustment using PI gain to deflection delta Id and delta Iq, The two phase three phase transducer M4 which carries out two phase (dq shaft) three phase conversion of the electrical-potential-difference control inputs Vd and Vq using the angle of rotation theta of Rota of the 2Y motor 22 detected by the angle-of-rotation sensor 68, and calculates each phase potentials Vu1, Vv1, Vw1, Vu2, Vv2, and Vw2, By the capacitor electrical potential difference Vc and voltage sensor 72 which were detected by the voltage sensor 70 As one of the detected cell voltage Vb and the command values about the drive of the 2Y motor 22 The capacitor armature-voltage control section M5 which calculates the potential difference V012 (the potential V01 of the neutral point of the three phase coil 24, and potential V02 of the neutral point of the three phase coil 126) during the neutral point for capacitor voltage adjustment based on target electrical-potential-difference Vc* of the capacitor 38 inputted, The angle of rotation theta detected by the angle-of-rotation sensor 68 is used. By the two phase three phase transducer M4 The 3rd higher-harmonic generation section M6 which generates the 3rd higher harmonic (sine wave with a frequency 3 times the frequency of each phase potentials Vu1, Vv1, Vw1, Vu2, Vv2, and Vw2) which synchronizes with each phase potentials Vu1, Vv1, Vw1, Vu2, Vv2, and Vw2 obtained, The adder M7 which adds this 3rd higher harmonic, each phase potentials Vu1, Vv1, Vw1, Vu2, Vv2, and Vw2 obtained by the two phase three phase transducer M4, and the potential difference V012 during the neutral point obtained by the capacitor armature-voltage control section M5, and acquires a modulating signal, It has the PWM signal operation part M8 which compares with the triangular wave as a subcarrier the modulating signal acquired by the adder M7, and calculates an PWM signal. In addition, control block indicated the block over the three phase coil 24, and the block over the three phase coil 26 as the same block. The PWM signal operation part M8 is the same as that of the usual motor control from the three phase two phase transducer M1 except for the point of adding the potential difference V012 and the 3rd higher harmonic during the neutral point, to each phase potentials Vu1, Vv1, Vw1, Vu2, Vv2, and Vw2 obtained by the two phase three phase transducer M4 in the two phase three phase transducer M4 and adder M7 list. The processing which calculates the potential difference V012 during the neutral point in the capacitor armature-voltage control section M5 For example, deflection deltaVc of target electrical-potential-difference Vc* of a capacitor 38 and the capacitor electrical potential difference Vc is calculated. It can carry out by calculating cell current command (current command during the neutral point) Io* for capacitor voltage adjustment using PI gain to this deflection deltaVc, and

calculating the potential difference V012 during the neutral point based on this cell current command Io* and cell voltage Vb.

[0031]

Drawing 7 is an explanatory view explaining signs that superimpose the 3rd higher harmonic and the modulating signal respectively corresponding to the three phase coils 24 and 26 of the 2Y motor 22 is acquired. In addition, although drawing 7 showed only modulating-signal Vu1* corresponding to u phase of the three phase coils 24 and 26, and Vu2*, it is the same as that of modulating-signal Vv1* corresponding to u phase, and Vu2* only by phases differing also about modulating-signal Vv1* corresponding to v phase and w phase, Vv2*, Vw1*, and Vw2*. The case where superimpose the 3rd higher harmonic V3 (degree type (3)) which has a frequency 3 times the frequency of modulated waves Vu1 and Vu2 in the modulated waves Vu1 and Vu2 (a degree type (1), (2)) (modulated wave before superimposing the 3rd higher harmonic) corresponding to the three phase coils 24 and 26, and modulating-signal Vu1* and Vu2* (a degree type (5), (6)) are generated now is considered. Here, Vc shows the electrical potential difference of a capacitor 28, and V0 shows the command value of the neutral point potential of the three phase coils 24 and 26.

Vu1=(2/root3) Vc-sin theta+V 0 (1)
Vu2=(2/root3) Vc-sin theta-V 0 (2)
V3=(1 / 3root3) Vc-sin3theta (3)
Vu1*=(2root3) Vc(sin theta+sin 3theta/6)+V0 (5)
Vu2*=(2root3) Vc(sin theta+sin 3theta/6)-V0 (6)

[0032]

In this case, if modulating-signal Vu1* after superimposing modulating signals Vu1 and Vu2 (refer to drawing 7 (a)) and the 3rd higher harmonic before superimposing the 3rd higher harmonic, and Vu2* (reference of drawing 7 (b)) are compared, so that it may illustrate Since the amplitude of modulating-signal Vu1* after superimposing the 3rd higher harmonic, and Vu2* can be made into 3root3 / twice as many amplitude as this to the amplitude of the modulating signals Vu1 and Vu2 before superimposing the 3rd higher harmonic even when outputting the same torque It turns out that modulating-signal Vu1* after superimposing the 3rd higher harmonic wave, and Vu2* can use efficiently the electrical potential difference Vc between terminals of a capacitor 38. In addition, the amplitude of the 3rd higher harmonic is set as the value suitable for making small the amplitude of modulating-signal Vu1* and Vu2*.

[0033]

As mentioned above, even if the electrical potential difference Vc of a capacitor 38 superimposes the 3rd higher harmonic wave on a modulated wave if the potential difference V012 during this neutral point can be held since it is controllable by the potential difference V012 during the neutral point of the three phase coils 24 and 26, the electrical potential difference Vc of a capacitor 38 does not vibrate. that is According to the current of the power outputted by the current impressed to the three phase coil 24, and the inphase impressed to the three phase coil 26 If the power outputted is the same (the amplitude of each phase potentials Vu1, Vv1, and Vw1 of the three phase coil 24, a frequency and the amplitude of each phase potentials Vu2, Vv2, and Vw2 of the three phase coil 26, and a frequency are the same) Even if it superimposes on this the 3rd higher harmonic which has the same frequency and the same amplitude mutually respectively, as shown in drawing 7 , since the potential difference V012 during the neutral point is held at a fixed condition, the electrical potential difference Vc of a capacitor 38 does not vibrate. By and the thing superimposed on the 3rd higher harmonic by each phase potentials Vu1, Vv1, Vw1, Vu2, Vv2, and Vw2 Since the amplitude of the modulating signal acquired by the adder M7 with the same torque decreases (root3 / twice), only the decrement can set up the amplitude of a modulating signal greatly (the maximum (2/root3) twice greatly), and can raise the output from the 2Y motor 22 about 15% of maxes.

[0034]

According to the power output unit 20 of an operation gestalt explained above, corresponded to each of the three phase coils 24 and 26. To each phase potentials Vu1, Vv1, and Vw1 and each phase potentials Vu2, Vv2, and Vw2 (modulating signal) which were obtained by the two phase three phase transducer M4 and which have the same amplitude and the same frequency mutually Since the 3rd higher harmonic wave which has the same amplitude and the same frequency mutually respectively is made to superimpose and switching control of the transistors T11-T16 of inverter circuits 30 and 32, and T21-T26 is carried out The amplitude maximum of a modulating signal can be decreased holding the electrical potential difference Vc of maintenance 38, i.e., a capacitor, for the potential difference V012 during the neutral point of the three phase coils 24 and 26 to target electrical-potential-difference Vc*. Consequently, the upper limit of the torque

outputted from the 2Y motor 22 can be raised more, without vibrating the electrical potential difference Vc of a capacitor 38.

[0035]

Although superposition of the 3rd higher harmonic to the modulated wave in the case of carrying out drive control of the 2Y motor 22 which has the three phase coil 24 and the three phase coil 26 was considered with the power output unit 20 of an operation gestalt, it is good also as what is applied when carrying out drive control of the 1st motor which has one 1st three phase coil among two three phase coils, and the 2nd motor which has the 2nd three phase coil of another side. however, when the same effectiveness as the power output unit 20 of an operation gestalt can be done so by superimposing the 3rd higher harmonic, [******] when controlling the 1st and 2nd motor by the same output It is restricted when the amplitude of each phase potentials Vu1, Vv1, and Vw1 (modulated wave before 3rd higher-harmonic superposition) of the 1st three phase coil, a frequency and the amplitude of each phase potentials Vu2, Vv2, and Vw2 (modulated wave before 3rd higher-harmonic superposition) of the 2nd three phase coil, and a frequency are the same.

[0036]

Next, the power output unit 120 of the 2nd operation gestalt of this invention is explained. Drawing 8 is the block diagram showing the outline of the configuration of the power output unit 120 of ** and the 2nd operation gestalt. The double winding motor 122 which has two three phase coils 124,126 by which Y connection was carried out so that the power output unit 120 of the 2nd operation gestalt may be illustrated (henceforth 2Y motor), Two inverter circuits 130,132 which are respectively connected to two three phase coils 124,126, and share the positive-electrode bus-bar 134 and the negative-electrode bus-bar 136, The capacitor 138 connected to the positive-electrode bus-bar 134 and the negative-electrode bus-bar 136, DC power supply 140 prepared during the neutral point of two three phase coils 124,126 of the 2Y motor 122, The current sensor 161 attached in the set section which gathered u phase of the three phase coil 124, and u phase of the three phase coil 126, It has the current sensor 162 attached in the set section which gathered v phase of the three phase coil 124, and the three phase coil v phase, the current sensor 167 attached during the neutral point of the three phase coil 124,126, and the electronic control unit 150 which controls the whole equipment. Thus, the power output unit 120 of the 2nd operation gestalt is changed to the current sensors 61-66 of the power output unit 20 of an operation gestalt, and is carrying out the same hard configuration as the power output unit 20 of an operation gestalt to u phase of the three phase coil 124, and u phase of the three phase coil 126 except for the point equipped with the common current sensor 162 at the common current sensor 161, and v phase of the three phase coil 124 and v phase of the three phase coil 126. Therefore, about the configuration corresponding to the power output unit 20 of an operation gestalt, 100 is added among the configurations of the power output unit 120 of the 2nd operation gestalt, a sign is attached, and the explanation is omitted.

[0037]

It is a hole current sensor and a servo type MAG current sensor, and a current sensor 161,162 detects the addition current adding two currents which flow the inphase of two corresponding three phase coils 124,126 as a current signal. In addition, although the common current sensor 161,162 shall be respectively attached in the set section of two u phases of the corresponding three phase coil 124,126, and the set section of two v phases with an operation gestalt, it is good also as what attaches a common current sensor also in the set section which gathered two w phases.

[0038]

In this way, actuation of the power output unit 120 of the constituted 2nd operation gestalt and each phase currents Iu1, Iv1, Iw1, Iu2, Iv2, and Iw2 which flow each phase of the three phase coil 124,126 especially using the detection result of a current sensor 161,162 and a current sensor 167 are calculated, and the actuation at the time of carrying out drive control of the 2Y motor 122 using this result of an operation is explained.

[0039]

Drawing 9 is drawing showing an example of u phase addition current Iu (=Iu1+Iu2) detected by the current sensor 161. Now, when the power outputted from the 2Y motor 22 by the current impressed to the three phase coil 126 is the same as the power outputted from the 2Y motor 22 by the current impressed to the three phase coil 124 of the 2Y motor 122, the case where have the respectively same amplitude and respectively same frequency as each phase of the three phase coil 124 and each phase of the three phase coil 126, and the phase current of an inphase is impressed is considered. u phase addition current Iu detected by the current sensor 161 becomes a thing adding the u phase current Iu1 of the three phase coil 124, and the u

phase current Iu2 of the three phase coil 126, as shown in drawing 9 . The same is said of v phase addition current Iv detected by the current sensor 162 and w phase addition current Iw calculated based on the detection result by the current sensor 161,162 only by phases differing. Therefore, a degree type can show w phase addition current Iw calculated based on v phase addition current Iv detected by u phase addition current Iu detected by the current sensor 161 and the current sensor 162 and the detection result of a current sensor 161,162. Here, Io is the zero phase current (current during the neutral point), and Io/3 are parts for one phase of the zero phase current. I is the amplitude of each phase currents Iu1, Iv1, Iw1, Iu2, Iv2, and Iw2.

[0040]

$$Iu=Iu1+Iu2=(I\cdot\sin\theta-Io/3)+(I\cdot\sin\theta+Io/3)=2\cdot I\cdot\sin\theta \quad (7)$$

$$Iv=Iv1+Iv2=(I\cdot\sin(\theta-2/3\pi)-Io/3)+(I\cdot\sin(\theta-2/3\pi)+Io/3)=2\cdot I\cdot\sin(\theta-2/3\pi) \quad (8)$$

$$Iw=Iw1+Iw2=(I\cdot\sin(\theta+2/3\pi)-Io/3)+(I\cdot\sin(\theta+2/3\pi)+Io/3)=2\cdot I\cdot\sin(\theta+2/3\pi) \quad (9)$$

Formula (7) The zero phase current Io is canceled and, as for the addition currents Iu, Iv, and Iw of - (9) to each phase, it turns out that it becomes the current which it has in the amplitude twice the amplitude of each phase currents Iu1, Iv1, Iw1, Iu2, Iv2, and Iw2, respectively. Therefore, each phase currents Iu1, Iv1, Iw1, Iu2, Iv2, and Iw2 of the three phase coil 124,126 can be calculated by the degree type using the detection result of a current sensor 161,162, and the detection result of the current sensor 167 attached during the neutral point. In addition, although the operation gestalt showed only a part for u phase, the same is said of v phase and w phase.

Iu1=Iu/2-Io/3 (10)

Iu2=Iu/2+Io/3 (11)

[0041]

If each phase currents Iu1, Iu2, Iv1, Iv2, Iw1, and Iw2 of such a three phase coil 124,126 calculate, the 2Y motor 22 can be driven by the usual motor control using this result of an operation.

[0042]

According to the power output unit 120 of the 2nd operation gestalt explained above, the common current sensor 161,162 is attached in u phase and w phase of two corresponding three phase coils 124,126, respectively. Based on the detection result by this current sensor 161,162, and the detection result of the current during the neutral point by the current sensor 167, each phase currents Iu1, Iv1, Iw1, Iu2, Iv2, and Iw2 of the three phase coil 124,126 are calculated. Since the 2Y motor 122 is driven using this result of an operation, it is not necessary to attach a current sensor in each of each phase of the three phase coil 124, and each phase of the three phase coil 126. Consequently, low cost-ization of the power output unit 120 is realizable.

[0043]

Although installation of the common current sensor 161,162 in the case of carrying out drive control of the 2Y motor 122 which has the three phase coil 124 and the three phase coil 126 was considered with the power output unit 120 of the 2nd operation gestalt, it is good also as what considers installation of the common current sensor in the case of carrying out drive control of the 1st motor which has one 1st three phase coil among two three phase coils, and the 2nd motor which has the 2nd three phase coil of another side. however, when the same effectiveness as the power output unit 120 of the 2nd operation gestalt can be done so, [******] It is restricted when controlling the 1st and 2nd motor by the same output (i.e., when the amplitude of each phase potentials Vu1, Vv1, and Vw1 (modulated wave) of the 1st three phase coil, a frequency and the amplitude of each phase potentials Vu2, Vv2, and Vw2 (modulated wave) of the 2nd three phase coil, and a frequency are the same).

[0044]

Although a capacitor 38,138 shall be connected to the positive-electrode bus-bar 34,134 and the negative-electrode bus-bar 36,136 in the power output unit 20,120 of the 1st and 2nd operation gestalt, it is good also

as what replaces with a capacitor 38,138 and connects DC power supply.
[0045]
The power output unit 20,120 of the 1st and 2nd operation gestalt is available also as what is not restricted to a three phase but connects DC power supply during the neutral point of a polyphase current coil, although DC power supply 40,140 shall be connected during the two neutral points of the three phase coils 24 and 26,124,126.
[0046]
The operation gestalt of further others is explained based on drawing 10 and 11. The 3rd higher harmonic was superimposed in the example of above-mentioned drawing 7 . In the example of drawing 10 , it replaces with this, and amendment is added so that the maximum electrical potential difference (maximum of the phase potential of instantaneous value) of each phase modulated wave may be in agreement with the forward side of the electrical potential difference Vc of a capacitor 38 in the potential of the neutral point of the three phase coil 24 connected to the forward side of DC power supply 40. By this, the electrical-potential-difference Vc utilization factor of a capacitor 38 can be made into max.
[0047]
namely
Vu1=(2/root3) Vc-sin theta+V 0 (1)
Vu2=(2/root3) Vc-sin theta-V 0 (2)
V3=1-MAX(Vu1,Vv1,Vw1)
(However, top-most-vertices =1 of a triangular wave, the lower point of a triangular wave = it is referred to as -1) (3)
Vu1*=(2root3) Vc-sin theta+V 3+V0 (5)
Vu2*=(2root3) Vc-sin theta+V 3-V0 (6)
It carries out.
[0048]
Thus, this is superimposed on each phase modulated wave (each phase current), using as V3 (amendment wave) the electrical-potential-difference value which subtracted the maximum electrical-potential-difference value of the modulated wave of a three phase circuit from the top-most vertices (forward side electrical potential difference of a capacitor 38) of a triangular wave. About the part into which the phase current exceeds the potential Vc of a capacitor 38, an exceeded part will be subtracted by this and the maximum of each phase modulated wave (phase potential) is in agreement with the electrical potential difference Vc of a capacitor 38 with this. Therefore, the utilization factor of the electrical potential difference Vc of a capacitor 38 can be made into max, the amplitude of modulating-signal Vu1* and Vu2* can be made small, and maximum output torque can be raised.
[0049]
Moreover, as shown in drawing 11 , amendment can also be added so that the minimum electrical-potential-difference value (minimum value of the phase potential of instantaneous value) of each phase modulated wave may be in agreement with the negative side of the electrical potential difference Vc of a capacitor 38 in the neutral point potential of the three phase coil 26 connected to the negative side of DC power supply 40.
[0050]
namely
Vu1=(2/root3) Vc-sin theta+V 0 (1)
Vu2=(2/root3) Vc-sin theta-V 0 (2)
V3=-1-MIN(Vu1,Vv1,Vw1)
(However, top-most-vertices =1 of a triangular wave, the lower point of a triangular wave = it is referred to as -1) (3)
Vu1*=(2root3) Vc-sin theta+V 3+V0 (5)
Vu2*=(2root3) Vc-sin theta+V 3-V0 (6)
It carries out.
[0051]
Like the case of drawing 10 , by superimposing the amendment wave V3, an exceeded part will be subtracted by this and the minimum value of phase potential is in agreement with the negative side of the electrical potential difference Vc of a capacitor 38 with this about the part into which the phase current exceeds the potential Vc of a capacitor 38 by the negative side. Therefore, the utilization factor of the electrical potential difference Vc of a capacitor 38 can be made into max, the amplitude of modulating-

signal Vu1* and Vu2* can be made small, and maximum output torque can be raised.
[0052]
As mentioned above, although the gestalt of operation of this invention was explained using the operation gestalt, of course, it can carry out with the gestalt which becomes various within limits which are not limited to such an operation gestalt of this invention at all, and do not deviate from the summary of this invention.
[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the outline of the configuration of the power output unit 20 which is 1 operation gestalt of this invention.
[Drawing 2] It is an explanatory view explaining the relation between the three phase coil 24 of the 2Y motor 22, and the three phase coil 26.
[Drawing 3] The potential difference V012 of the neutral point of the three phase coil 24 and the neutral point of the three phase coil 26 is the explanatory view explained to the leakage inductance of the three phase coils 24 and 26 of the 2Y motor 22 paying attention to the flow of the current in a condition smaller than the electrical potential difference Vb of DC power supply 40.
[Drawing 4] The potential difference V012 of the neutral point of the three phase coil 24 and the neutral point of the three phase coil 26 is the explanatory view explained to the leakage inductance of the three phase coils 24 and 26 of the 2Y motor 22 paying attention to the flow of the current in a larger condition than the electrical potential difference Vb of DC power supply 40.
[Drawing 5] It is the explanatory view showing a wave-like example of each phase potentials Vu1, Vv1, Vw1, Vu2, Vv2, and Vw2 of the three phase coils 24 and 26 when operating it so that the difference of the potential V01 of the neutral point of the three phase coil 24 and the potential V02 of the neutral point of the three phase coil 26 may serve as the electrical potential difference Vb of DC power supply 40.
[Drawing 6] It is the block diagram showing the drive control performed with the electronic control unit 50 of the power output unit 20 of an operation gestalt as control block.
[Drawing 7] It is an explanatory view explaining signs that superimpose the 3rd higher harmonic and the modulating signal respectively corresponding to the three phase coils 24 and 26 of the 2Y motor 22 is acquired.
[Drawing 8] It is the block diagram showing the outline of the configuration of the power output unit 120 of the 2nd operation gestalt.
[Drawing 9] It is drawing showing an example of u phase addition current Iu (=Iu1+Iu2) detected by the current sensor 161.
[Drawing 10] It is an explanatory view explaining signs that superimpose the amendment wave about the maximum of the modulated wave of each phase, and the difference of a capacitor electrical potential difference, and the modulating signal respectively corresponding to the three phase coils 24 and 26 of the 2Y motor 22 is acquired.
[Drawing 11] It is an explanatory view explaining signs that superimpose the amendment wave about the maximum of the modulated wave of each phase, and the difference of a capacitor electrical potential difference, and the modulating signal respectively corresponding to the three phase coils 24 and 26 of the 2Y motor 22 is acquired.
[Description of Notations]
20,120 24 A power output unit, a 22,122 2Y motor, and 26 Three phase coil, 30 32,130,132 An inverter circuit and 34,134 Positive-electrode bus-bar, 36,136 A negative-electrode bus-bar and 38,138 A capacitor and 40,140 DC power supply, 50,150 An electronic control unit, 52,152 CPU, 54,154ROM, 56,156 RAM, and 61-67,161,162 A current sensor and 68,168 70 An angle-of-rotation sensor and 72,170,172 A voltage sensor, T11-T16, and T21-T26 A transistor, D11-D16, D21-D26
Diode.

[Translation done.]

* NOTICES *

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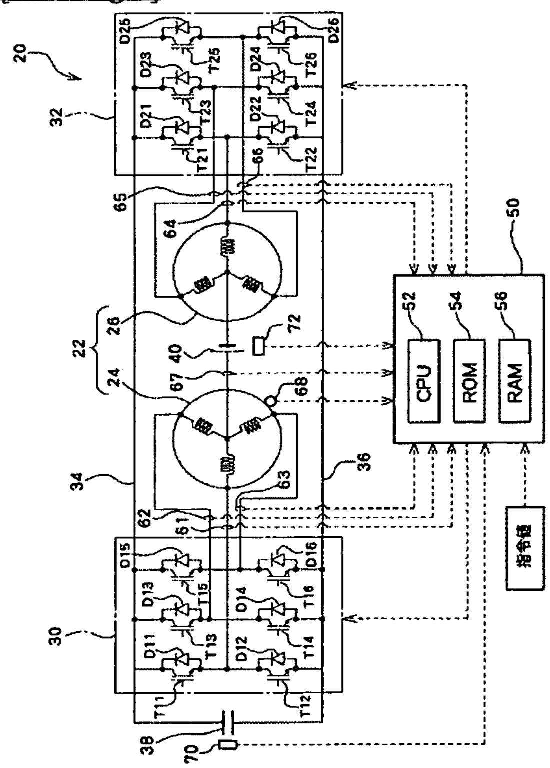
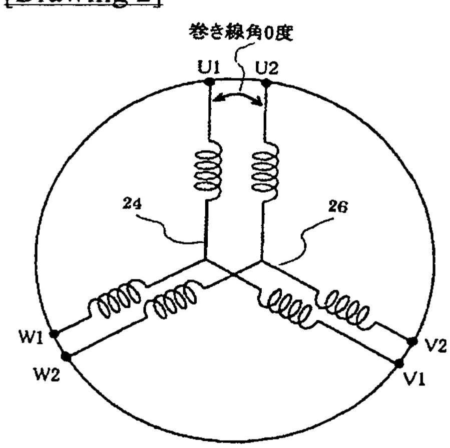
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

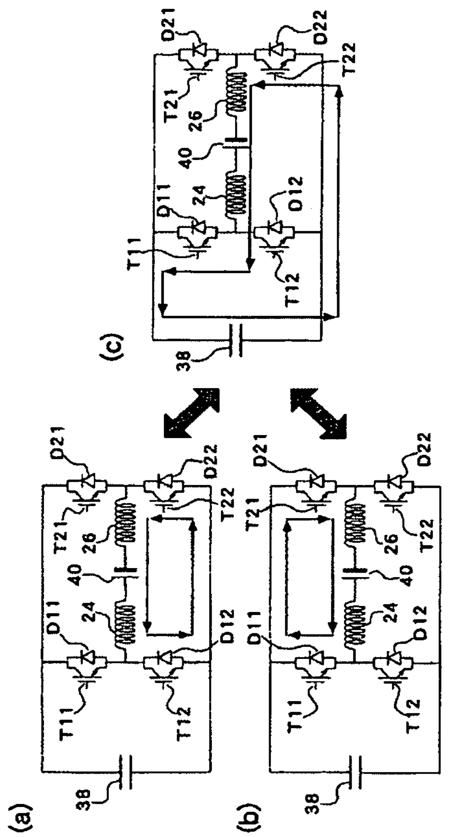
[Drawing 1]



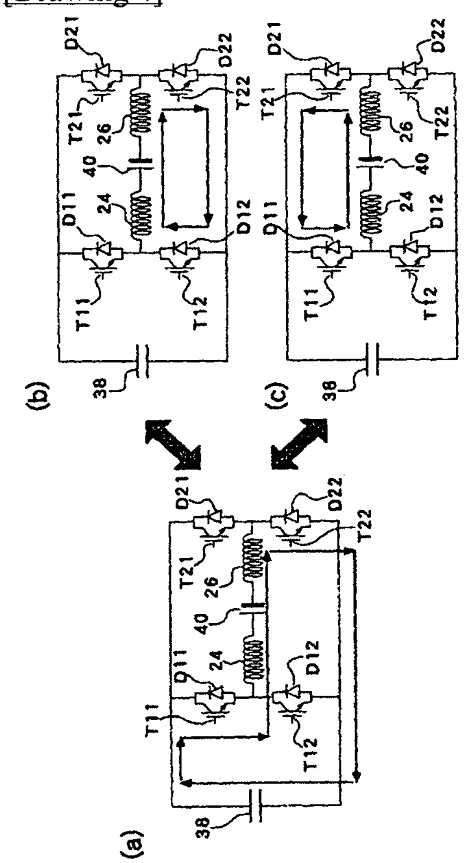
[Drawing 2]



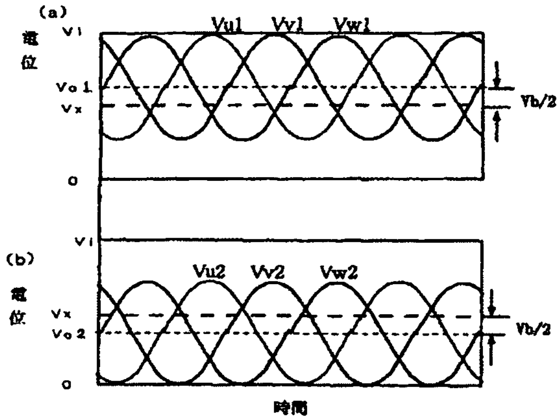
[Drawing 3]


(a)
(b)
(c)
D21
D22
T21
T22
26
40
24
D11
D12
T11
T12
38

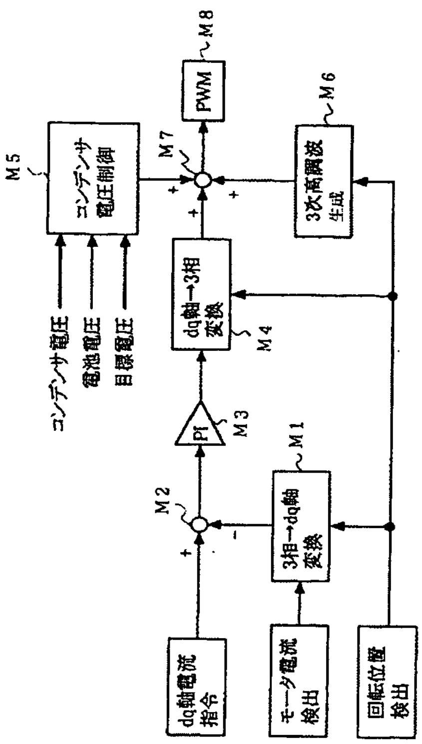
[Drawing 4]


(a)
(b)
(c)
D21
D22
T21
T22
26
40
24
D11
D12
T11
T12
38

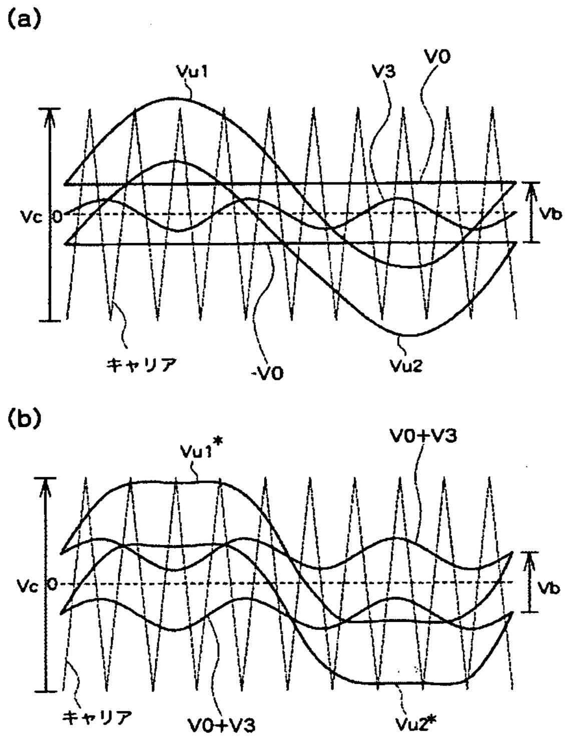
[Drawing 5]



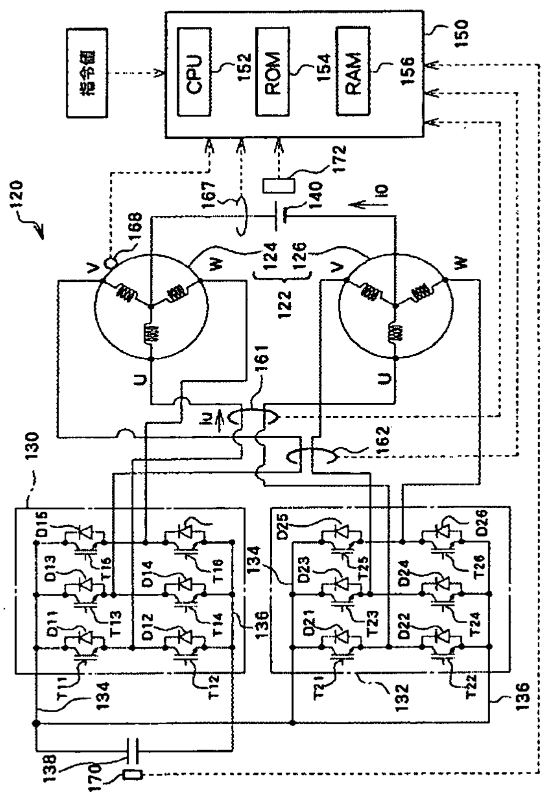
[Drawing 6]



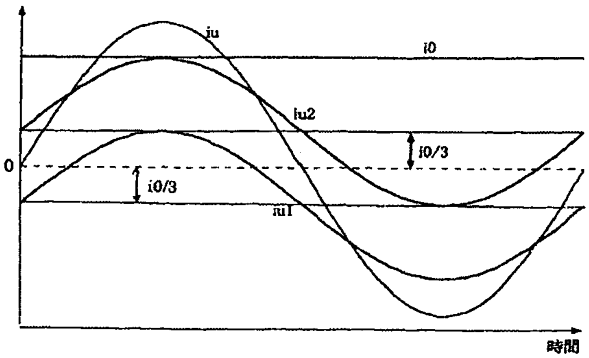
[Drawing 7]



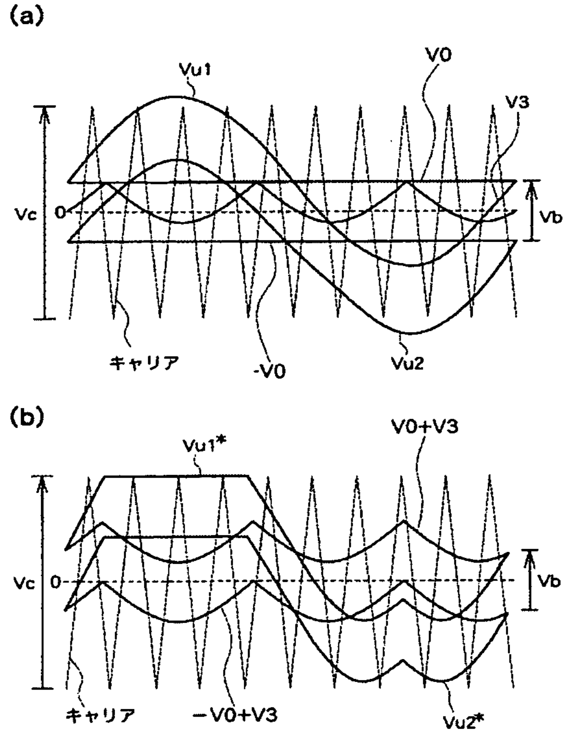
[Drawing 8]



[Drawing 9]

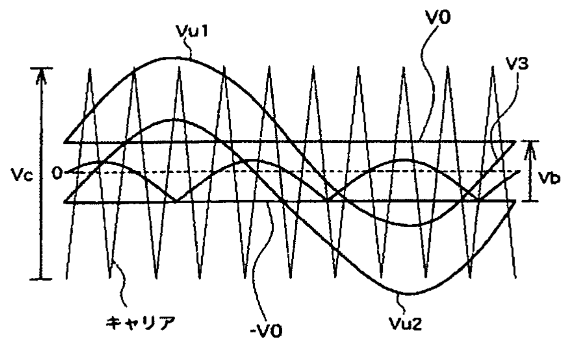


[Drawing 10]

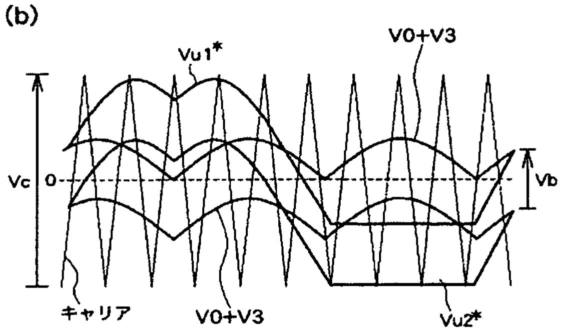


[Drawing 11]

(a)



(b)



[Translation done.]